I. ECOLOGY

Ecology – is a chemical and biological engineering science, that:

- studies the structure and functioning of systems of the supraorganism level (population, community, ecosystem) in time and space in human-modified conditions and in the natural environment;
- determines what impacts of anthropogenic and non-anthropogenic origin affect the environmental situation, including the spread of bacterial and viral diseases;
- develops engineering (including genetic engineering) methods for diminishing negative impact on the biosphere.

Modern environmental science is an interdisciplinary science that studies the problems of interaction between man and the biosphere, namely, the role of man in nature and changes in nature under the influence of anthropogenic factors. Regarding the world-wide growing industry, the negative impact on nature, the planet and mankind itself is constantly increasing. Industrial enterprises contribute heavily to air pollution that negatively affects respiratory systems of the human body, leading to a number of chronic and fatal diseases; the pollution is present on crops, it enters the soil, groundwater and the human body. Wastewater pollutes rivers and water bodies, making them unsuitable for organisms and thus disrupting the functioning of entire ecosystems. An important problem is the emission of greenhouse gases from cars when burning fuel. All of these are examples of the negative impact of anthropogenic activities. In addition, there are non-anthropogenic impacts, primarily associated with volcanic activity, earthquakes and solar activity. If the situation continues to develop in this direction, the humanity is under a threat of a global environmental disaster. In this regard, the issue of Green Industry, of reducing negative impact on nature, the planet and man is a matter of utmost urgency.

Relevant topics

1) Clean air: condition monitoring, sensors, measurements of pollution in atmospheric air and emissions, modeling and predicting the state of atmospheric air using digital twins, air quality control;

2) Pure water: development of the best available water purification technologies, technological rehabilitation of water bodies, hybrid technologies for transferring industrial and agricultural enterprises to a closed water cycle;

3) An integrated solid waste management system: developing the best available technologies for processing solid industrial waste, designing finished products based on the life cycle, taking into account the subsequent collection and disposal, technology of biodegradable materials to reduce the overall load on the ecosystem;

4) Natural resources management, including the development of algorithms for the rational use of planetary resources, energy and resource-saving technologies, production and microchipping of organic products for use by a traceability system;

5) Bioecology: the study of the relationships of living organisms with their environment, study of the influence of certain groups of animals, insects, microorganisms on

environmental changes, developing ways of reducing the risks of human intoxication with mycotoxins of plant materials; autecology: the study of the individual relationships of individual species of organisms on the environment; the study of biological methods of controlling plant pests (the study of the ecological mechanisms of the influence of the locust family on the fauna and environmental situation of the regions; the influence of the river beaver population on the change in the physical, geographical and environmental characteristics of their habitats, etc.);

6) Virus and pathogen ecology; the impact of viruses and bacteria on the planet, in particular, the impact of the COVID-19 pandemic on the environmental situation in the world; issues of the emergence, spread, and possible mechanisms for stopping disease outbreaks. Emergency preparedness and response;

7) Human ecology, including the development of technical and methodological systems for improving the physical and psychological state of a person in the short and long term, as well as the development of environmentally friendly materials and design solutions for creating environmentally friendly housing, including eco-settlements;

8) Environmental compliance: the ability of an organization, city, region to comply with environmental norms and rules, both external and internal, including assessment, management and control systems associated with the risks of non-compliance with regulatory documents, rules and standards of supervisory authorities, legislation requirements.

II. MATERIALS SCIENCE

Materials science is an interdisciplinary branch of science that studies the methods of production, structure and properties of materials, the relationship between their composition, structure and properties (mechanical, thermal, chemical, electro-physical, magnetic, optical) and the behavior of materials depending on various factors.

In the modern world, materials science is one of the most promising areas of natural science and a locomotive of technological progress. Advances in space exploration, new means of communication, computers, smartphones, artificial implants (in medicine) and the widespread use of laser technology - these and other achievements would not have been possible without previous achievements in materials science. Knowledge of the structure and properties of materials allows you to create fundamentally new products, as well as new industries. At the same time, the knowledge gained by scientists in the field of materials science is in demand by traditional industries and is widely used to improve safety and economic efficiency of production, expand the product range, develop technological innovations and solve existing production problems. Without new research in the field of materials science, further development of electronics, metallurgy, mechanical engineering, aircraft manufacturing, building materials industry, chemical and textile industries, the industry of new carbon and polymer structural and composite\nano materials, as well as of other industries is impossible.

Relevant topics

1) New metallic materials, as well as the new generation metal-matrix composite materials (both construction and functional); the development of methods for designing automotive, aerospace, and construction products using aforementioned materials;

2) Materials for additive manufacturing, including gas-dynamic spraying and laser surfacing; nano and microadditives in alloys, prediction of the properties of metals and alloys with additives, technology for the production of innovative steels and products from them;

3) New functional materials, including nanomaterials, whose operational characteristics (magnetic, electrophysical and optical properties, catalytic activity) can be changed using quantitative control;

4) Materials resistant to extreme conditions, including new polymers and nanomaterials, for energy sector (including nuclear energy, as well as actively developing sectors of alternative energy) and for space sector;

5) Nature-like medical materials (including hybrid and nanostructured), in particular, innovative polymers and the creation of artificial organs based on them;

6) New composite materials resistant to extreme conditions (including Arctic conditions), for use in the construction industry;

7) New functional and construction materials, including nanomaterials containing carbon, namely: fullerenes, carbon nanotubes, graphene, glassy carbon, etc.;

8) Nature-like materials for use in modern electro-chemical energy sector: magnetic, ferroelectric, luminescent and ion-conducting mineral-like functional materials, including new mineral-like piezoelectric and optical materials;

9) Minerals and mineral-like compounds as components of heat-resistant ceramics and matrix-immobilizers of toxic and radioactive elements.

III. ARTIFICIAL INTELLIGENCE

Artificial Intelligence (AI) is one of the current breakthrough scientific directions. The AI research is conducted in all developed countries of the world. The AI can be described as a set of solutions that allows to simulate the human mental functions (including learning and self-training, as well as finding a solution without a given algorithm) and based on this to obtain results comparable to the results of human intellectual activity. The AI research results are actively implemented into all spheres of life. In medicine, systems are developed and implemented for automatic processing of test results, diagnostic data and monitoring of treatment methods. In industry, it is now possible to track equipment wear, fulfillment of production plans and other activities that are usually done manually. In agriculture, the use of artificial intelligence allows for proper control over the condition of plants, the level of moisture, the availability of nutrients in the soil and for well-timed care of plantings that are automatically weeded, watered and harvested. The AI can be used in road traffic management for analyzing data from traffic lights and collecting information on traffic congestion, unforeseen accidents, negative weather conditions and other factors affecting traffic. By analyzing the data, AI can adjust the operation of the road system. In everyday life, AI is best represented in the form of the Smart Home system, which optimizes energy consumption, level of heating and ventilation, and control over the operation of household appliances.

Relevant topics

1) Development and application of artificial intelligence methods for solving the digital industry challenges (sensorics of industrial facilities, creation of digital twins, energy saving, information security of industrial facilities);

2) Creation of a multibiometric information system using artificial intelligence methods, surpassing in its capabilities all known biometric systems in the world;

3) The use of artificial intelligence to solve the environmental problems of large industrial agglomerations;

4) Creation of advanced computer vision systems for solving a wide range of tasks (control of production processes, medical diagnostics, adaptive traffic control, safety and counter-terrorism, production of autonomous robotic devices);

5) Development of methodology and algorithms for the classification and formation of forecasts based on the analysis of Big Data;

6) Machine learning methods for solving combinatorial optimization challenges (application of combinatorial optimization: to develop the optimal air traffic network; to develop the best way to deliver goods; in applied sociology; in business research – to predict the behavior and preferences of consumers, competitors and markets, etc.);

7) Development of algorithms for creating synthetic images based on the architecture of generative-competitive neural networks (creation of technology for improving Deep HD images based on generative-competitive neural networks);

8) Development of a unified payment system based on cryptocurrency; improvement of national payment systems and their continuous implementation as an element of economic cooperation between the BRICS countries in the face of growing market risks of the global payment infrastructure.

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BRICS YOUNG INNOVATOR PRIZE
Terms and Conditions

1. The Prize

The 3rd BRICS Young Innovator Prize contest will be part of the 5th BRICS Young Scientists Forum (5th BRICS YSF) that will take place on XX XXXXXX, 2020 in XXXXX, Russia, under the Russian Presidency in BRICS.

The Prize aims to recognise and reward the best results related to research, development and innovation projects that represent technological innovation and a potential contribution to the science and technology sector of the BRICS countries. It is in special recognition of young talented entrepreneurs and researchers, whose outstanding innovations will make a profound impact on the socio-economic environment and conditions of life in BRICS societies. These bright young students, researchers and entrepreneurs drawn from science, engineering and allied disciplines will represent BRICS next generation scientific and technological leadership.

2. Requirements

2.1. Requirements for the Projects

The submitted projects **must be innovative**.

The projects must be at the pre-market stage (not available for mass consumer acquiring, not presented as a public offer even at the local market). Projects at the stage of limited product testing, non-serial production, certification or preparation for launching the product on the market are accepted.

The Prize focuses on **projects and prototypes** that should be used to improve their respective sectors/ industries.

There are 3 thematic areas of the 3rd BRICS Young Innovators Prize that have been selected based on their high importance in all BRICS countries:

- Ecology
- Materials Science
- Application of Artificial Intelligence in the areas of Ecology and Materials Science.

This implies that all of the submitted projects must be dedicated to one of these topics. Projects on other topics will not be considered.

The Projects should focus on major social, economic, developmental or environmental challenges and provide innovative solutions that aim to enhance conditions of life in contemporary BRICS societies. The project must be relevant minimum for 3 out of 5 BRICS countries (its actual challenges).

The volume of sales of the project presented must not exceed 100 000 $ for the last calendar year before the competition. Corporate innovations are not accepted (projects that are developed on the basis of a technology company by its employees). Also, the project should not be merged with any other technology company and not be in the process of being merged at the time of participation in the contest.

Participation in the BRICS Young Innovator Prize contest implies a participant’s agreement that the Terms and Conditions stated herein are binding on him/her.

2.2. Requirements for the Participants

Candidates to the BRICS Young Innovator Prize must be under the age of 30 (maximum of 29 years old to the day of the award panel – 11 September 2020) to be eligible for participation.

Candidates must be bound to BRICS member countries, either by nationality (born or naturalized) or by residence (persons with permanent residence visas).

Candidates may not submit more than one project. Candidates must be the initial authors of the project submitted.

Participation in the BRICS Young Innovator Prize will be restricted to 4 (four) candidates per country from each BRICS member state, from among the young innovators taking part in the 5th BRICS Young Scientists Forum.

Each BRICS member state may conduct the national selection of the candidates on a competitive basis or through a process of nomination.

2.3. Requirements for the Submissions

The projects must be submitted by the BRICS respective Ministries of Science, Technology and Innovation **until 20 July 2020**, according to each member's rules, via email, addressed to: brics2020@mniop.ru with a copy to kutuzovaaa@minobrnauki.gov.ru.

All submissions must contain the following documents:

- Application form (completed, signed and dated);
- Project description: A MS Word document consisting of not more than 5 (five) pages, including not more than 4 pages of graphs, drawings, charts and/or illustrations, in the following format: A4 size, Arial font, size 12, 1.5 spacing, top/lower margin: 2.3cm, left/right: 3.0cm;
- Copy of identity document or passport;

Application form must contain the following information:

- A brief description of the project and its innovative component (up to 100 words);
- Problem definition the project solves;
- Target audience of the project;
- Current indicators (over the past 2 years): what stages have been passed, what significant marks in development have been hit, what are the financial / quantitative indicators;
- Development strategy (for the next 1-2 years);
- Potential prospects of application (possible use of technology in 3 years or more);
- Current project request (what resources are needed; financial budget and for what purpose);
- The applicant's role in the project and the total number of people in the team indicating their competencies or areas of responsibility in the project;
- Links to the website and social network pages of the project;
- Domestic / international awards / diplomas (if there are any)

All personal and project information must be submitted in English.

The e-mail with the application form, documents and archives of project must not exceed 20 Mb.

Inconsistent, incomplete or late submissions will not be accepted.

The application form cannot be changed in their respective contents after they have been sent to the Ministry.

The project description must include:

- A brief description of the contestant's innovative technology consisting of not more than six hundred (600) words, that conveys the essence of the contestant's solution, omitting full details of technology, training and/or design;
- A detailed description of the proposed solution including an outline of how it is supposed to address a clearly defined social, economic, developmental or environmental challenge;
- An explanation of the broad outline of the proposed product in layman's terms, stating the benefits of said solution over existing solutions.

The description alluded above may include any/all of the following resources:

- A PowerPoint presentation consisting of not more than 12 slides;
- A video of 8 minutes reachable by link visualisation.

Both formats are accepted, neither has an advantage over another when rating.

Please, note that adjudicators do not evaluate grant or investment obtainment as well as certification. Both possession and lacking are accepted, neither has an advantage over another when rating.

3. Evaluation

3.1. Pre-selection

The project that does not meet the requirements of the regulation, whether by format, content, incorrect category, submitted documentation or other criterion that precludes exempt analysis of plagiarism, will be disqualified at any time.

There will be a primary selection of the submitted projects by the Ministries of Science, Technology and Innovation of each respective BRICS country, which can be done on a competitive basis or through a process of nomination.

Up to four projects will be sent by the BRICS STI Ministries to the Ministry of Science and Higher Education of the Russian Federation, which will check the prerequisites and organise the contest.

The organisers of the BRICS Young Innovator Prize contest will reserve the right to reject submissions without notice, including the cases supplying false registration information and/or non-compliance of the Terms and Conditions or the guidelines of the BRICS Young Innovator Prize contest.

There is no legal recourse possible against the decision of disqualification. The adjudicators' decisions including both procedural and reasoning will be final and will not be open to contest or review.

The selected projects will be presented to an adjudication panel, during the 5th BRICS YSF, which will choose the winners based on the established criteria.

3.2 Presentation of applications to an Adjudication panel

The participants will be required to make a presentation of their projects to an expert panel comprising representatives of the BRICS member states.

The presentation of the project can be edited until the day before the in-person presentation. On the eve of the day of performance the presentation file must be sent to the organizers in its final edition and cannot be changed at the day of performance.

The presentation of each project is limited to 10 minutes.

All information provided during the presentation must be in English. Usage of translation devices or translator services is not allowed.

The presentation must be individual. Only 1 person is accepted for each presentation.

The participation in Q&A session must be individual. Only 1 person is accepted for each project. The participation of other delegates is not allowed.

Usage of paper / electronic notes / cues during the presentation is allowed. Both reading and speaking are rated equally, neither has an advantage over the other when rating.

The prototype could be demonstrated by photos, videos or in-person at the discretion of the participant. All formats are accepted, neither has an advantage over the other when rating. The lack of demonstration is allowed but can cause the loss of points by criterion "Consistency of the technical information presented: presentation of procedures that prove the technical functionality of the product or process".

The adjudication panel will comprise independent experts designated by the BRICS member states. Each BRICS member state will designate one independent expert to ensure balance, fairness and transparency in the adjudication process.

The adjudication panel will choose the winners without establishing the classification of the other candidates. It may not grant the Prize if it considers that there are no qualified projects.

4. Winners Selection

Each presentation of the project will be evaluated according to the following criteria:

- Innovative impact of the project (its novelty, trending, social impact, relevance to the current challenges the society of the BRICS countries faces)- 10 points
- Short term applicability (current demand and relevance) - 5 points
- Long term applicability (prospective demand and relevance) - 2 points
- Technical feasibility (accessibility of implementation, how much the presentation displays an understanding of how to implement this technology)- 5 points
- Market feasibility (business model of the project, its applicability and advantage over competitors) - 5 points
  Each adjudicator evaluates feasibility for its own local market.
- Quality of the presentation of the project (clarity, consistency of information, grammar and methodology) - 5 points

After this evaluation, an oral defence, followed by a Q&A session, will define the ranking of the winners according to the following criteria:

- Consistency between written and presented project: logic of presentation, persuasiveness, clarity and structure of information, strength of argumentation and evidence base–5points
- Consistency of the technical information presented: theoretical basis of other authors, presentation of procedures that prove the technical functionality of the product or process - 10 points
- Visioning: quality of long-term planning, how much this project can be influential in a few years - 5 points
- Project team: expertise and competences of the team members - 5 points.
- Assessment step is always 1 point.

After the presentations, the adjudication panel will have a meeting to complete the final scoring before the announcement of the winners. The decision of the adjudication panel will be final and irreversible.

5. Prizes

Successful participants will receive the following prizes after applicable verification and subject to compliance with the rules and conditions of BRICS Young Innovator Prize contest:

First Prize: Twenty-five thousand Dollars (USD 25,000) or the currency equivalent in BRICS member states to the First Prize winner as determined by the adjudication panel of the BRICS Young Innovator Prize contest.

Second Prize: Fifteen thousand Dollars (USD 15,000) or the currency equivalent in BRICS member states to the Second Prize winner as determined by the adjudication panel of the BRICS Young Innovator Prize contest.

Third Prize: Ten thousand Dollars (USD 10,000) or the currency equivalent in BRICS member states to the Third Prize winner as determined by the adjudication panel of the BRICS Young Innovator Prize contest.

The organizers reserve the right to introduce some extra nominations (it could be either with cash prize or without it) to pursue the goal to recognize additional outstanding qualities of the projects presented as well as the innovators themselves such as the best presentation, jury's award etc. Information about extra nominations will be provided on the opening day of the Forum.

6. Intellectual Property Rights

Each contestant is solely responsible for taking the necessary actions that they deem appropriate to protect their intellectual property rights, prior to filing a submission with the BRICS Young Innovator Prize organisers. Such actions may include obtaining legal counsel such as advice from an attorney ora professional experienced in intellectual property law. The Terms and Conditions of this contest do not prescribe or give preference to any specific course of action or strategy (e.g. filing for patents) as such decisions remain the business prerogative of the contestant. The BRICS Young Innovator Prize organisers disclaim any responsibility to take action to protect the intellectual property rights of any contestant.

7. General

By entering the BRICS Young Innovator Prize, the contestant agrees:

- That the organisers of the contest have no duty of confidentiality with respect to the materials that their submission comprises, and acknowledges that the filing of a submission and participation in the public presentation may be deemed to be the publication of their invention;
- That the organisers of the contest may publicly disclose or reproduce any part or all of the contestant's submission as well as any presentation materials;
- That if the contestant becomes a finalist that they will not enforce any IPRs that they own or control or their solution against any person who uses this solution for their personal use;
- To waive any moral rights to materials submitted in relation to the BRICS Young Innovator Prize contest;
- That the organisers of the contest may use the place of residence, image and likeness of the contestant in publications and promotional materials. Conversely, the organisers of the contest agree that the contestant may use the description «BRICS Young Innovator Prize» in publications in relation to the contest. However, the contestant is not authorised to use the BRICS 2020 Summit logo, nor state or imply that the organisers of the contest approve or endorse the contestant or the contestant's solution;
- That the organisers of the contest may photograph and/or create videos, and/or visual or audio-visual works of all or any part of the presentations and Q&A sessions and awarding

of prizes and may use, reuse, publish and republish, display and reproduce these images in whole or in part, with or without alteration or modification, without the contestant's inspection or approval;

- That they do not have any interest (whether under copyright or otherwise) in any of the images or any creative works incorporating those images.

Projects and documents will not be returned to the candidate and will not be considered in future calls of the Prize.

Ministries will not be responsible for proposals not received as a result of possible technical problems and network congestion.

The presentation of the registration implies the acceptance of the present Terms and Conditions by the candidates, as well as full responsibility for the information provided.

The decisions of the adjudication panel shall not be subject to appeals or challenges at any stage of the process.

The authors authorise the prize organisers to use their names and images in any type of media.

The organisers of the prize will not participate in the profits obtained from the project.

The authors of the awarded projects are protected by the right to present them in exhibitions, meetings, congresses and to allow their dissemination by the press or any other means, with or without commercial purposes.

The omissions and any doubts or situations not provided for in the rules shall be judged and decided in a sovereign manner by the organisers of the prize or by the Adjudication Panel.

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